A CAUTIONARY NOTE ON THE USE OF OVIPOSITION RECORDS AS LARVAL FOOD PLANT RECORDS

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Abstract

Butterflies may lay their eggs on species of plant which are unsuitable as sources of food for their larvae. This has led to some misleading records in the secondary literature. This contention is illustrated by detailed treatment of three examples: *Euploea core*/*Asclepias* spp., *Cressida cressida*/*Aristolochia elegans* and *Danaus plexippus*/*Araujia hortorum.* The reasons why such 'mistakes' in oviposition occur and their coevolutionary history is discussed.

Introduction

Comments received recently from a journal referee prompt us to point out the care which must be taken in using the presence of eggs of particular species of insects on a plant, as evidence that the plant is necessarily to be considered a food plant for the insect. This seems to be an especially pertinent problem when the insect or the plant or both are recent arrivals in the region concerned. Records based on observations of eggs or early instar larvae which, unbeknown to the observer, fail to develop, frequently get into the secondary literature such as hand-lists and field guides. The authors of such works, of course, must use published food plant records and are not in a position to check out all of them themselves, especially as this may require extended periods of observations to resolve the questions we raise here. It is therefore, a case of *caveat emptor* as far as the entomologist using such information is concerned. We illustrate this contention with three case histories from our own work or that of our colleagues on the ecology of butterflies.

Case 1: *Euploea core* Cramer and *Asclepias* spp.

In extended studies of the oviposition dynamics of *Danaus plexippus* L. and *D. chrysippus* L. we monitored eggs laid on patches of *Asclepias fruticosa* L. (Zalucki and Kitching, 1982). Throughout our period of observation, the highly distinctive globular eggs of *Euploea core* occurred regularly on our sentinel plants. Common and Waterhouse (1981) and Fisher (1978) record "*Asclepias* spp." as a food plant for both *E. core* and its congener *E. eichhorni* Staudinger. We followed the subsequent progress of these eggs throughout a season, and although they hatched, on no occasion did we find feeding larvae on the plants. In our experience, then, there seems no reason to include *Asclepias* spp. as food plants of *E. core* although they do provide a way of monitoring the egg-laying phenology of the species (Kitching and Zalucki, 1981). Casual observations suggest that *A. curassavica* L. and *A. physocarpa* (E. Mey) Schlecht may act in the same way as *A. fruticosa.* The species of *Asclepias* concerned were introduced to Australia from the West Indies in the case of *A. curassavica* and from southern Africa in the case of the other two species (Everist, 1974). The range of *E. core* does not encompass either of these areas and one must suppose that the two species have not been in contact long enough for the processes of coevolution to have altered the behaviour patterns of the butterfly. It must be supposed, though, that the visual and chemical signals emitted by *Asclepias* are very similar to those given out by acceptable food plants such as native *Parsonsia* spp. and the exotic oleanders, *Nerium* spp.

Case 2: *Cressida cressida* (F.) and *Aristolochia elegans* (Mast.).

The Dutchman's pipe vine, *A. elegans*, is a commonly-grown garden plant in subtropical parts of Australia. In extended observations, we have found that it is very attractive to ovipositing females of *Cressida cressida* and may be inundated with the bright orange eggs of the butterfly. Indeed, at peak periods of female activity, two plants kept under close observation had hardly a leaf of the current year's growth without one or more eggs. First instar larvae will not, in our experience, feed on this species and die if denied access to more acceptable food plants such as the native species, *A. indica* L., *A. pubera* R.Br. and *A. thozetii* F.Muell. *A. elegans* as "cultivated Dutchman's pipe", is listed as a food plant by Burns and Rotherhan (1969) although both Common and Waterhouse (1981) and McCubbin (1971) note its unpalatability. As in the case of *Asclepias* spp. and *Euploea, A. elegans* may act, nevertheless, as a useful tool in the study of the population dynamics of *Cressida cressida* females for which it may act as a 'supernormal' stimulus for oviposition (*sensu* Tinbergen, 1951).

Case 3: *Danaus plexippus* L. and *Araujia hortorum* Fourn.

The moth-plant, *Araujia hortorum*, is widely recorded as a food plant of *Danaus plexippus* (Common and Waterhouse, 1981; McCubbin, 1971; Fisher, 1978; D'Abrera, 1971). In experiments in which we offered female *D. plexippus* a choice of plants on which to oviposit only 14 of a total of 824 eggs were laid on *A. hortorum* when offered in combination with *Asclepias curassavica, A. fruticosa* and *A. physocarpa.*

Of more significance, perhaps, is the observation that of these 14 eggs, none developed past the third larval instar. Also the developmental rate of these larvae was about half that of larvae reared on *A. fruticosa* and *A. curassavica* at the same time and under otherwise identical conditions. Mr D. James (pers. comm.), however, has reared larvae successfully on *A. hortorum* from the fourth larval instar.

Discussion

These three case histories from our own observations illustrate the difficulties inherent in using oviposition records as indications of food plants and, secondarily, point up the complications associated with any attempt to define the term 'food plant'. The examples can be multiplied. *Polyura pyrrhus* (L.) will lay on *Jacaranda* sp., *Euploea core* will lay eggs on frangipani leaves and Coleman (1962) records *Graphium sarpedon* L. ovipositing in large numbers on leaves of cultivated avocadoes. Recent observations of D. P. Sands (pers. comm.) on *E. core* indicate that this species may occasionally complete its larval life successfully on frangipani. These observations of course do not mean that the species of butterfly concerned will never feed on the plants named and the quoted references may well reflect genuine records of feeding. However we have been unable to bear them out.

The key to why the insects should make 'mistakes' in their oviposition behaviour lies in current notions of coevolution. These suggest, among other things, that two species that are in contact over a long period of time may develop finely tuned interactions to the advantage of individuals of one or other or both species. A butterfly in contact with a range of potential food plants will develop, through time, mechanisms of choice that ensure the survival of its offspring. Individuals which deposit eggs on unsuitable plants will leave less offspring than otherwise and eventually this tendency will be eliminated from the population. Alternatively the butterfly may develop biochemical or other mechanisms to overcome the defence mechanisms of the plant concerned. Both of these evolutionary mechanisms, however, take time. The insect, of course, may be able to cope fortuitously with the new contact as in the case of the Indo-Australian *E. core* and the Mediterranean *Nerium* spp. In a similar case the northern Queensland species, *Pachliopta polydorus* L., is able to use *Aristolochia elegans* in addition to the native species of *Aristolochia* (D. P. Sands, pers. comm.).

In the three case histories described above, the butterfly/plant contact is post-European settlement of Australia. The chemical and visual signals emanating from the unsuitable plant species must be sufficiently similar to those of plants that are acceptable to the butterflies due to previous coevolutionary episodes. Given sufficient time it is likely that these 'mistakes' in oviposition will be eliminated or circumvented by physiological changes in the larvae.

The *D. plexippus/Araujia hortorum* case suggests that defining a 'food plant' of a butterfly simply as a species of plant on which the larvae of the species is seen to feed, is not enough. A better but still workable definition would be "a plant on which the species can complete its immature feeding period and then successfully complete pupal/adult metamorphosis". Even this may not suit the purists as there could well be second or later generation effects due to a plant species that is only marginally unsuitable. This later extension of the problem, however, requires for its resolution substantial amounts of close observation of the species concerned which will be out of the question for all but a small proportion of species.

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